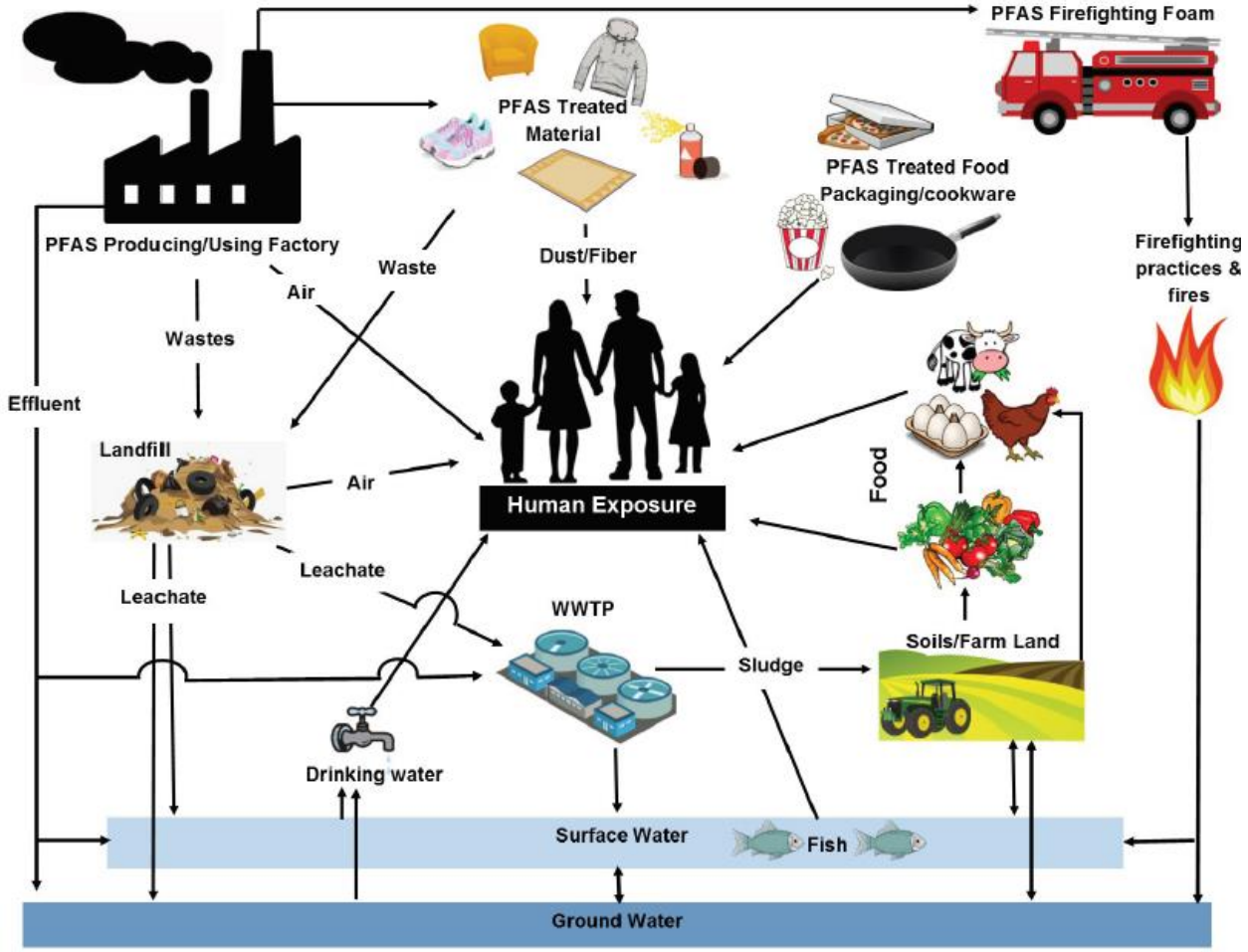
Per- and Polyfluorinated Alkyl Substances

What are they?

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a large group of human-made chemicals that have been used in industry and consumer products worldwide since the 1940s. Their ability to repel water and oil and withstand high temperatures has made PFAS a particularly useful ingredient in industrial and commercial products, including non-stick products, stain- and water-repellent clothing, and aqueous film forming foams (AFFFs). These chemicals do not easily break down in the environment and have been known to accumulate in the environment and humans. The acronym PFC has been used to describe PFAS in the past. This acronym is no longer used to describe per- and polyfluoroalkyl substances (PFAS) because it is used to describe perfluorocarbons (i.e., refrigerants), which are a different family of chemicals.



Sources of PFAS and modes of human exposure. *Image credit: Maine Drinking Water Program, Service Connection newsletter, Volume 25, Issue 4. Image adapted from Oliaei et al., 2013.*

Humans may be exposed to PFAS in several ways, including: drinking municipal or private well water contaminated by PFAS, eating fish caught from water contaminated by PFAS, accidentally swallowing soil or dust contaminated by PFAS, eating food that was packaged in material that contains PFAS, and using consumer products that contain PFAS. In a nationwide study, low levels of PFAS were determined to be present in the blood of most Americans.

Although PFAS have been used extensively since the mid-20th century, experts are just recently understanding their potential impacts to human health. This understanding continues to evolve based on ongoing research. The specific PFAS perfluorooctane sulfonate (PFOS), perfluorooctanoate (PFOA), perfluorohexane sulfonate (PFHxS), and perfluorononanoic acid (PFNA) are the most studied PFAS chemicals. Current studies of these PFAS suggest exposure may affect childhood development, decrease female fertility, increase the risk of high blood pressure in pregnant women, increase cholesterol levels, increase the risk of thyroid disease, and decrease antibody response to vaccines. EPA research suggests that some PFAS may have the potential to cause cancer, however, studies linking the two have been inconsistent and require further research.


Firefighters spraying foam on structures. Image credit: NPS

Currently, there is limited regulatory authority of PFAS at the federal level. In 2016, the EPA issued a non-enforceable Lifetime Health Advisory level for PFOA and PFOS of 70 parts per trillion (ppt) in drinking water and in February 2020 released an updated PFAS action plan titled, EPA PFAS Action Plan: Program Update, that, among other steps, pledges to work under the Safe Drinking Water Act (SDWA) to make a regulatory determination for PFOA and PFOS. Currently, the DNR, under Chapter 292, Wisconsin Statutes, has authority to require parties that discharge PFAS to the air, land, and waters of the State to take action to restore the environment to a practicable level. DNR's Water Quality Program has authority to regulate discharges to surface water on a site-by-site basis in accordance with the federal Clean Water Act. With respect to groundwater, in June of 2019 the Wisconsin Department of Health Services (DHS) recommended a groundwater enforcement standard of 20 parts per trillion (ppt), as a combined standard for PFOS and PFOA, as part of the 10th Cycle of Groundwater Standards Proposals. To become enforceable, the recommended standard needs to go through the State's formal rulemaking process and be incorporated into ch. NR 140, Wis. Adm. Code. Until that time, persons undertaking groundwater cleanups of PFAS contamination are required to work with DNR and DHS to establish a site-specific cleanup standard.

Occurrence in Wisconsin

Under the Safe Drinking Water Act's third Unregulated Contaminants Monitoring Rule (UCMR-3), select municipal water systems were asked to test for PFOA and PFOS, between 2013 and 2015. PFAS were detected in public water systems in La Crosse, West Bend, and Rhinelander. Testing has also been conducted voluntarily by several municipal water systems and included a more comprehensive list of PFAS (i.e. additional compounds such as those included as part of EPA's Method 537.1). These testing efforts identified PFAS in varying concentrations in municipal water systems in Marinette, Peshtigo, Madison, and Rhinelander.

PFAS have also been found in groundwater near Department of Defense sites in Wisconsin, such as Wisconsin Air National Guard facilities at Truax Field and Volk Field. PFAS are present in many consumer products and AFFFs and also can be released from industrial facilities that manufacture or use the compounds. Therefore, PFAS are potentially present at fire departments, industrial facilities, landfills, and wastewater treatment plants due to the diverse waste streams accepted from industrial and municipal parties. PFAS have also been identified in municipal wastewater treatment plants' biosolids. As biosolids are put to beneficial reuse via agricultural landspreading, this may be an important pathway for the substances to enter groundwater.

At present, the DNR is continuing to identify PFAS sources and their potential impacts to groundwater and other environmental media in Wisconsin.

GCC Agency Actions

Currently, there are no state or federal groundwater protection standards for PFAS. To address this regulatory gap, the DNR formally requested that DHS provide recommendations for groundwater enforcement standards for two PFAS, PFOA and PFOS, in accordance with State law. In June of 2019, based on a review of thousands of peer-reviewed studies, the DHS recommended a groundwater enforcement standard of 20 parts per trillion (ppt) for combined levels of PFOA and PFOS. Upon receiving recommendations, the DNR has begun the formal rulemaking process to promulgate amendments to NR 140. The formal process may take up to 30 months.

The DNR, in April of 2019, also requested that DHS review toxicologic information on 34 PFAS compounds and, if appropriate, provide recommendations for ch. NR 140 groundwater standards. This request was designated the "Cycle 11" review of substances for possible groundwater standards development. DHS is currently in the process of reviewing toxicologic information available for substances on the Cycle 11 list.

The DNR is formulating a strategy to address PFAS in the State. This will include voluntary sampling by WPDES discharge permit holders, municipal fire departments, and municipal wastewater treatment plants. Additional statewide PFAS biosolids and sludge testing will occur in the coming years and, given the ubiquitous nature of PFAS, it is expected that the detection of more widespread PFAS impacts will occur. To effectively protect human health and the environment from potential risks associated with the land application of PFAS containing biosolids, a PFAS land application numerical value should be developed in order to appropriately regulate and authorize land spreading proposals where PFAS has been detected. Wisconsin will be drawing on the examples and experiences of other states to guide future PFAS efforts at State agencies that protect groundwater resources within the State.

Further Reading

DNR PFAS page: https://dnr.wi.gov/topic/Contaminants/PFAS.html

DHS Groundwater Contaminant recommendation process: https://www.dhs.wisconsin.gov/publications/p02432.pdf

Interstate Technology and Regulatory Council fact sheets: https://pfas-1.itrcweb.org/

US Agency for Toxic Substances and Disease Registry PFAS page: https://www.atsdr.cdc.gov/pfas/index.html

US Environmental Protection Agency PFAS page: https://www.epa.gov/pfas

References

Oliaei, F., Kriens, D., Weber, R., Watson, A., 2013. PFOS and PFC releases and associated pollution from a PFC production plant in Minnesota (USA). Environ. Sci. Pollut. Res. 20, 1977–1992. https://doi.org/10.1007/s11356-012-1275-4